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PATENT SPECIFICATION

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(54) IMPROVEMENTS IN AND RELATING TO CONTROL DEVICES FOR OLEOPNEUMATIC JACKS

(71) We, COMMISSARIAT A L'ENERGIE ATOMIQUE, an organisation created in France by ordinance No. 45-2563 of 18th October 1945, of 29 Rue de la Federation, Paris 15e, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a control device for an oleopneumatic jack, more particularly for obtaining rapid return of the rod of the jack when the operating oil pressure ceases to act on the opposite surface of a plunger bearing this rod.

A principal object of the invention is to ensure a rapid return whatever the position of the plunger in the jack cylinder, the maximum return speed being restricted only by the diameter of the pipe admitting driving oil into the cylinder and by the viscosity of the oil, and the piston stroke depending only on the discharge volume available to the oil expelled from the cylinder.

To this end, there is provided in accordance with the invention a control device for an oleopneumatic jack comprising a cylinder containing a movable plunger, the interior of the cylinder to one side of the plunger being connected to a first pipe provided with a first valve and for connection to a source of compressed air and the interior of the cylinder to the other side of the plunger being connected to a second pipe provided with a second valve, the second pipe being also connected to the lower portion of an oil reservoir of which the upper portion is connected to a third pipe provided with a third valve and for connection to a source of compressed air, and wherein the oil reservoir is arranged in parallel with a circuit comprising a discharge vessel which is connected to the interior of the cylinder to the other side of the plunger by a duct provided with a fourth valve and to the lower portion of the reservoir by way of a non-return valve.

The following description, given by way of example only, illustrates an embodiment of the control device according to the invention. In the accompanying drawing, the single figure is a diagrammatic sectional view of such a device.

This figure shows the cylinder 1 of an oleopneumatic jack containing a plunger 2. The lateral surface of the plunger bears piston rings 3, so that the plunger defines two chambers 6, 7 in the cylinder which are separated from one another in a fluid-tight manner. That side of the plunger 2 facing the chamber 6 is provided with a rod 8 which passes through the end 4 of the cylinder.

The chamber 6 is connected by a first pipe 9 to a source (not shown) of compressed air, which enters this pipe in the direction of arrow 10. The pipe 9 includes a pressure-gauge connection 11 and a first three-way electrically controlled valve 12, of which one way or exit is connected to a duct 13 to permit escape of the air pressure inside the chamber 6.

The chamber 7 beneath the piston 2 is filled with operating oil from a reservoir 15, in which a record pipe 14 is deeply immersed. This pipe includes a second electrically controlled valve 16 and a flow regulator 17. The oil in the reservoir 15 is pressurised by means of compressed air, admitted into this reservoir along a third pipe 19 which leads into the upper portion of the reservoir and includes a third three-way electrically controlled valve 20, having a duct 21 to permit air from the reservoir to escape. This pipe 19 is connected to the same compressed-air supply as the first pipe 9, and it also includes a pressure-gauge connection 22.

The device embodying the invention is completed by a circuit, arranged in parallel with the reservoir 15, consisting essentially of a discharge vessel 23 connected by a fourth pipe 24 to the chamber 7, by way of a fourth electrically controlled valve 25, and to the lower portion of the reservoir 15 by way of a non-return valve 26. The latter has a ball 27 and a suitably calibrated return spring 28, which urges the ball onto its seat in order to close the pipe 24.

The control device described above operates as follows:

(a) *Plunger upstroke*

The valves 16, 20 are open, the valve 25 being closed and the valve 12 positioned to connect the pipe 9 to the duct 13. Under these conditions, the air pressure above the oil level 18 in the reservoir 15 increases, and oil forced into the pipe 14 progressively fills the chamber 7 and lifts the plunger.

(b) *Plunger downstroke*

The electric valves 12, 16 are open, valve 20 is positioned to connect pipe 19 to the duct 21. In this case, the air pressure in the chamber 6 increases, the plunger 2 is forced downwards and expels the oil from its chamber 7 into the reservoir 15. The level 18 rises, expelling the air above the level 18 in the reservoir.

(c) Stopping *plunger in intermediate position in either stroke*

The plunger may be stopped in any position by arranging for the valves 12, 20 to be open and valves 16 and 25 to be closed, so that the oil is locked in the chamber 7.

(d) *Rapid return of plunger*

The rapid return is effected by opening the valve 12, which supplies the chamber 6 in the cylinder 1 with pressurised air, and connecting pipe 19 to outlet duct 21. Since the reservoir 15 has an appreciable volumetric capacity, the time required to empty the compressed air contained in this reservoir through the escape duct 21 of the valve 20 is necessarily somewhat long. In order to overcome this disadvantage and to permit rapid return of the plunger, in accordance with the invention, the discharge vessel 23 is used, this being connected in parallel with the reservoir 15 by opening the valve 25 and simultaneously closing the valve 16. The oil contained in the chamber 7 is therefore immediately diverted towards the vessel 23 which is at atmospheric pressure, the non-return valve 26 preventing oil from entering this vessel from the reservoir 15 when the latter is under pressure. During the rapid descent of the plunger 2, the vessel 23 fills with oil, its pressure increasing progressively. The speed of the plunger diminishes correspondingly, becoming zero if the discharge vessel is fairly small, so that the return movement of the plunger is progressively cushioned. At this instant the valve 25 is closed and the valve 16 is opened. The plunger 2 then continues its stroke slowly, at a speed controlled by the regulator 17, acting on the flow rate of the oil flowing to the reservoir 15.

During the above-mentioned operations, the pressure inside the reservoir 15 drops because the valve 20 connects the pipe 19 to the outlet duct 21. When this pressure drops below that prevailing in the vessel 23, the non-return valve 26 opens, the ball 27 compressing its spring 28. The oil contained in the vessel 23 flows along the pipe 24 to the reservoir 15 until the pressure in the vessel becomes equal again to the atmospheric pressure, when the non-return valve closes again. The initial conditions have then returned.

The above described control device is very simple and permits a rapid return of the plunger of an oleopneumatic jack at a speed restricted only by the diameter of the oil escape pipe 24. The end of the return movement of the plunger is automatically cushioned, and the piston stroke and the cushioning of the movement depend only on the volume available in the discharge vessel.

Obviously, the invention is by no means restricted to the embodiment particularly described and illustrated. On the contrary, it includes all variants of this embodiment which lie within the scope of the appendant claims. In particular, the upward and return speeds of the plunger may be the same or different.

WHAT WE CLAIM IS:—

1. A control device for an oleopneumatic jack comprising a cylinder containing a movable plunger, the interior of the cylinder to one side of the plunger being connected to a first pipe provided with a first valve and for connection to a source of compressed air and the interior of the cylinder to the other side of the plunger being connected to a second pipe provided with a second valve, the second pipe being also connected to the lower portion of an oil reservoir of which the upper portion is connected to a third pipe provided with a third valve and for connection to a source of compressed air, and wherein the oil reservoir is arranged in parallel with a circuit comprising a discharge vessel which is connected to the interior of the cylinder to the other side of the plunger by a duct provided with a fourth valve and to the lower portion of the reservoir by way of a non-return valve.

2. A control device for an oleopneumatic jack as claimed in claim 1, wherein the pressure in the discharge vessel is equal to the atmospheric pressure.

3. A control device for an oleopneumatic jack as claimed in either claim 1 or claim 2, wherein the first and third valves are three-way valves of which one way is connected to an escape duct for compressed air.

4. A control device for an oleopneumatic jack as claimed in any of claims 1 to 3, wherein the second pipe is provided with a

flow regulator for regulating the flow of the oil.

5. A control device for an oleopneumatic jack as claimed in any of claims 1 to 4, wherein the non-return valve has a ball co-operating with a seat under the influence of a calibrated spring.

6. A control device for an oleopneumatic jack as claimed in any of claims 1 to 5, wherein the valves are electrically controlled.

7. A control device for an oleopneumatic jack substantially as herein described with reference to the accompanying drawings.

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